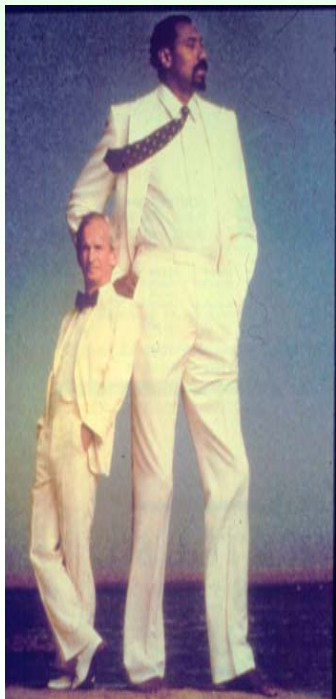


7.345 The Chemistry and Biology of Carbohydrates, Key Molecules of Life

Fall 2003. Wednesdays, 3-5 pm. Room 68-151.

Instructor: Kuberan Balagurunathan (kuby@mit.edu, 3-8803; laboratory of Robert Rosenberg)



Carbohydrates differ from other biological polymers, such as nucleic acids and proteins, in many ways. Most importantly, they have different functional groups that provide almost unlimited variations in their structures. Carbohydrates that are conjugated to proteins or lipids are termed glycoconjugates. They decorate the outer surface of mammalian cells. Their strategic location enables them to regulate many important biological processes, including fertilization, cell growth, cell-cell adhesion, cell-cell communication, development, immune defense, viral and parasitic infection, degradation of blood clots, inflammation etc. Furthermore, alterations in the synthesis or catabolism of cell-surface carbohydrates are associated with various pathological conditions, including malignant transformations and congenital and neurological disorders. Deciphering the enigmatic structures of carbohydrates and understanding their biosynthetic/catabolic pathways are critical for the development of carbohydrate-based therapeutics. In this course, we will discuss the tools available to characterize carbohydrate structures, methods to synthesize carbohydrates, the biosynthesis and catabolism of carbohydrates, and the role of carbohydrates in human diseases and developmental disorders such as cancer, congenital defects, and Sanfilippo disease.



Alterations in the biosynthesis of the most abundant cell-surface carbohydrate Heparan Sulfate may result in various abnormalities in growth including Dwarfism (left figure), Simpson-Golabi-Behmel Syndrome in humans (left figure), and obesity in the mouse (right figure).

Grading: This course is graded pass or fail.

Field Trip: We will take a field trip in the middle of the semester to a biotechnology company actively involved in carbohydrate research.